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HALOPHILOUS COLLEMBOLA OF JAPAN¹⁾

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With 5 Text-figures

Located along the eastern border of the Asian continent the halophilous Collembola of the Japanese archipelago furnishes special interest in the scope of biogeography. From the time when FOLSOM 1899 has described the first halophilous species of Japan from Miyagi, Bôshû (Pref. Chiba) based on materials collected by Prof. CHIYOMATSU ISHIKAWA, the founder of Zoology in Japan, some 10 species of them have been already reported. In the following the revised list of them is given including the description of some new species. The majority of them have been collected during my two years survey in Kii (Pref. Wakayama) and Amakusa (Pref. Kumamoto) and the main halophilous species of the western Japan would be probably included in it. Hearty thanks are directed to Prof. T. TOKIOKA and other stuffs of the Seto Marine Biological Laboratory for their helps and advices in the course of the study.

Hypogastruridae

1. *Hypogastrura* (*Ceratophysella*) *communis* (FOLSOM, 1897)

Susami, Pref. Wakayama (1 ex. 14. IV 1970, R. YOSHII); Tororo in Amakusa, Pref. Kumamoto (many ex. 5. V 1970, R. YOSHII).

This is the cosmopolitan haloxene species.

2. *Xenylla arenosa* UCHIDA et TAMURA, 1967

The species is described from Akkeshi, Hokkaido. Halobiont.

Pseudachorutidae

3. *Friesea* (*Conotelsa*) *pacifica* (YOSHII, 1958)

The species is described from Beppu, Pref. Oita and lately reported from Akkeshi,

1) Contributions from the Seto Marine Biological Laboratory, No. 533.

Hokkaido (UCHIDA et TAMURA 1966). Halobiont.

4. *Friesea (Conotelsa) oshoro* UCHIDA et TAMURA, 1966

It is a halobious species known from Oshoro and Zenibako in Hokkaido.

5. *Oudemansia esakii* (KINOSHITA, 1932)

Pseudachorutes esakii: KINOSHITA 1932, UCHIDA 1950.

Oudemansia esakii: YOSII 1957.

Sugashima, Pref. Mie (2 ex. 19. VII 1970, H. MORINO); Mogi, Pref. Nagasaki (1 ex. 4. V 1970, R. YOSII); Tomioka in Amakusa, Pref. Kumamoto (5 ex. 5, IV 1969, T. KIKUCHI).

The species is described from the shore of Tsushima and later found from Seto, Pref. Wakayama and Manazuru, Pref. Kanagawa.

6. *Oudemansia subcoerulea* DENIS, 1948

(Fig. 1)

Hatakejima in Seto, Pref. Wakayama (6 ex. 19. VII 1968, R. YOSII); Shirahama, Pref. Wakayama (3 ex. 25. VI 1970, S. NISHIMURA).

Body length 1.5 mm. Colour dark violet throughout in alcohol. ant.: head as 1:1, ant. segm. ratio as 15:15:14:12. Ant. III, IV almost confluent. Ant. IV with 3 apical bulbs and some 3 curving sensory setae. Ant. III-organ is two short rods without groove. Buccal cone protruded anteriorly. Labrum elongate distally, warty on basal part. Setae are 4/3, 4, 2, the most distal pair is very long. This character of labrum is common with *O. esakii*. Mandible elongate, feebly serrate on one side near apex. Maxilla styliform. Eyes 8+8, poorly chitinised, without forming eye field. Postantennal organ absent. A pair of peculiar foveal structure on both sides of area occipitalis is present. Legs short, without tenent hair. Unguis carinate and with one inner tooth. Unguiculus absent. Ventral tube with 2+2 setae as in *O. esakii*. Rami tenaculi tridentate. Furca short, man:dmu as 24:18:6. Manubrium dorsally with 7+7 setae. Dentes converging, dorsally granulate and with 6 subequal setae. Mucro boat-shaped, ventrally keeled and with two broad margins almost untoothed. Abd. VI is rounded, with 4 prominent anal spines in a transverse row, they are large and lightly curved distally representing a_1 , a_2 setae of the segment. Integument is finely and equally granular all over. Body setae are feeble, arranged in two transverse rows in all tergites. Th. I has 3+3 setae. s.s. is not distinguished from other setae.

Our specimens coincide well with DENIS' description of this species from Vietnam. As the range of its distribution is so wide, it would be equal with *O. coerulea* SCHÖRT,

1893. However, the dorsal view of abd. VI reveals that the anal spines are not so slender as SCHÖTT's figure and unguis has always one inner tooth. *Polyacanthella oceanica* UCHIDA, 1955 of Marcus Is. and *O. hirashimai* UCHIDA, 1965 of Iriomote Is. would be identical with this species. Halobiont.

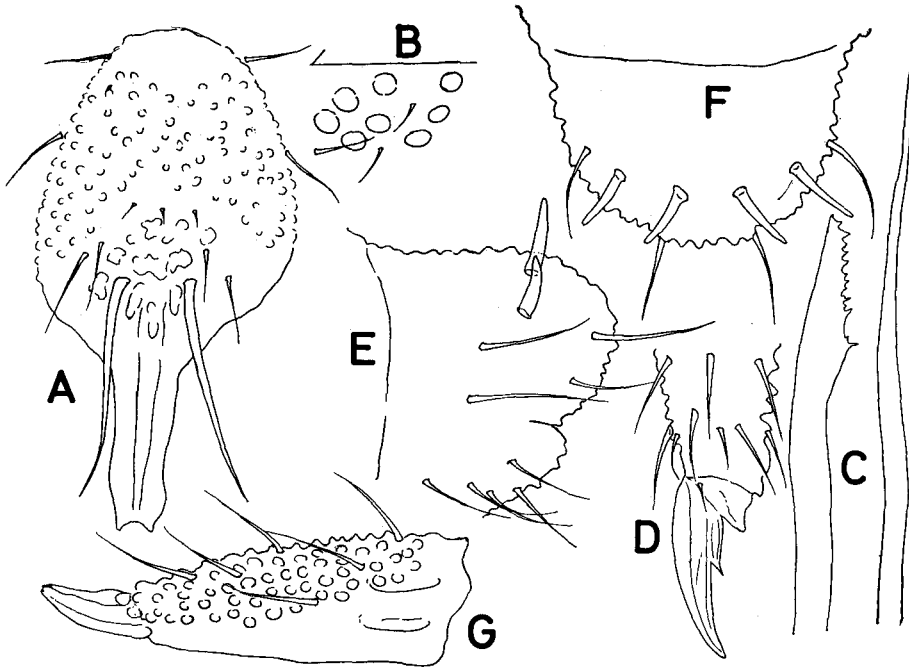


Fig. 1. *Oudemansia subcoerulea* DENIS from Shirahama, Seto A: labrum, B: eyes, C: mandible and maxilla, D: hind claw, E, F: abd. VI in lateral and dorsal view, G: dentes and mucro.

7. *Pseudanurida billitonensis* SCHÖTT, 1901

The species is first known from the Island Billiton near Singapore. In Japan it is found from Takarajima (YOSHII, 1955), Kikaigashima (UCHIDA, 1962) and Iriomote (YOSHII, 1965), all from the Ryukyu Archipelago.

Neanuridae

8. *Lobella pacifica* sp. n.

(Figs. 2, 3D)

Tomioka in Amakusa, Pref. Kumamoto (many ex. 20. V 1970, R. YOSHII); Shingu and Kushimoto, Pref. Wakayama (many ex. 16. IV 1970, R. YOSHII); Hara in Shimabara, Pref. Nagasaki (1 ex. 7. V 1970, R. YOSHII).

Colour totally white in living and in alcohol. Body up to 2.4 mm in length, rather slender as all the body tubercles are reduced. It has the appearance of *Onychiurus* or *Anurida* of the *granaria* group in living. Ant. IV with 3 apical bulbs and 7 sensory setae. p-seta present. Ant. III-organ is composed of two short rods in a groove, both d- and v-seta present. Postantennal field in form of a smooth area is readily present, but eyes and eye-pigment are quite absent. Labrum truncate apically, with 2+2 long setae. Mandible triangular distally, with 3-4 intermittent teeth

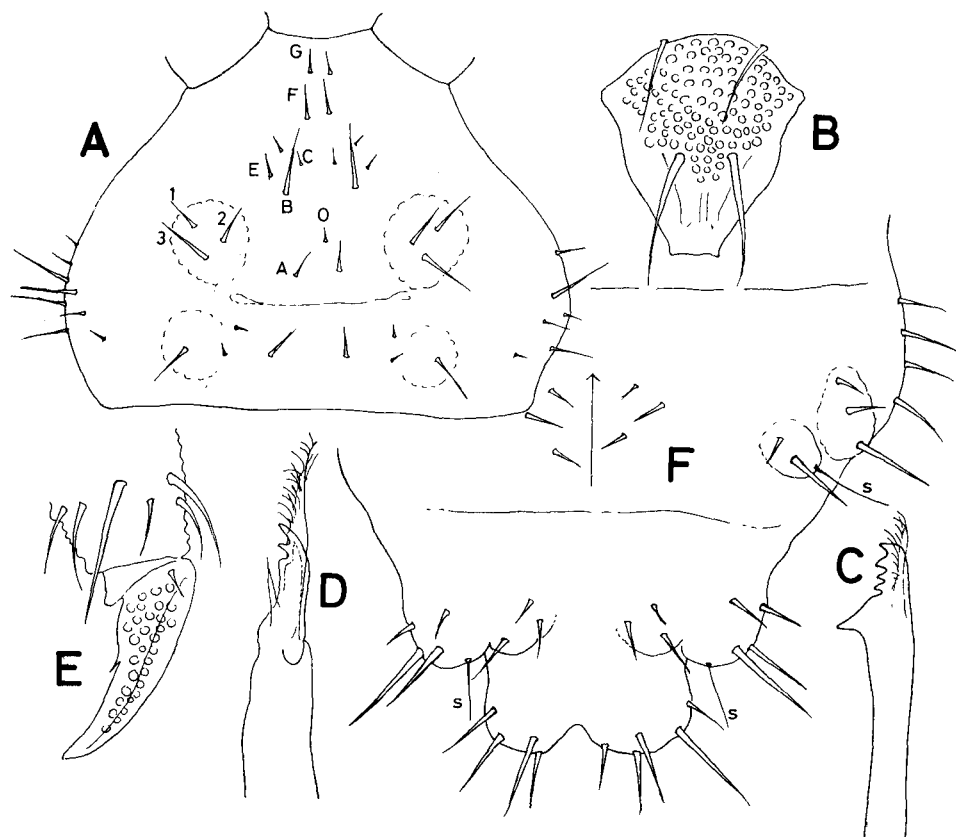


Fig. 2. *Lobella pacifica* sp. n. A: head, B: labrum, C: mandible, D: maxilla, E: hind claw, F: abd. IV-VI.

and fringed lamella, the latter is surpassing the shaft. Maxilla elongate, the main shaft is tridentate as usual and one hyaline, strongly fringed lamella is much surpassing the shaft. Unguis broad, with a small inner tooth and its inner side is uniformly granular up to the distal part. Ventral tube with 4+4 setae. Furcal rest is a median round swelling with some 5-7 setae on it. Segmental tubercles are faintly present. Head bears a pair of ocular, subdorsal and lateral tubercles, others are quite reduced, o-seta present. B- and F- seta a little longer than others. Ocular tubercle bears 3 setae

(oc-1, 2, 3) subequal in length. Trunk bears no dorsal tubercle on th. I to abd. IV. The chaetal arrangement is as follows:

head:	1,	ii+1,	—.
th. I:	1,	i+1,	1.
th. II, III:	ii+1,	s+ii+1,	1+ii+s, iii+1.
abd. I-III:	ii+1,	ii+1+s,	i+1, 4—5.
abd. IV:	ii+1,	i+1+s,	3, ca. 8.
abd. V:	ii+1+s+4.		

The presence of 3 setae of the dorsal group on abd. I-IV is very characteristic, but aberrant cases with 2 setae may occur very frequently on some of the body segments or on one side of a certain segment. On abd. V dorsal tubercle is displaced laterally and fused with the lateral tubercle leaving a faint furrow of the integument between them. On abd. VI a pair of tubercles are placed side by side. All body setae are short and somewhat spiny, none of them are modified. s.s. are slender. Typus: 1♂ from Tomioka in Amakusa.

This is the true halobiont species found among the heap of sea-weeds hauled up on the shore. It is alike to *L. tongana* Yosii, 1964, of South Pacific having 3 setae of the dorsal group on abd. I-IV. The cited species is insufficiently known with respect to the chaetal arrangement of the head. Revision of the paratype reveals that in this species D-seta of the head is very near F and ocular tubercle bears only one large and one minute seta. On abd. IV subdorsal tubercle bears 3 setae and s.s. is lying on an independent small tubercle near by. On abd. V dorsal and lateral tubercles are fused completely without any suture. These crucial characters are figured in fig. 3, A-C, as the complement of my previous description.

9. *Lobella halophila* (YOSII, 1955)

(Fig. 3 E, F)

Yuukiamura halophila: YOSII 1955

Following additional diagnosis is to be given. On the head only ocular, subdorsal and lateral tubercles are to be defined, others being quite reduced. o-seta present. B-seta is larger than others. Ocular tubercle bears 3 setae, oc-2 is very long, while other setae are small. 3+3 unpigmented eyes are irregular in arrangement according to the individual, but present in all examples. Chaetal arrangement as follows:

head:	1,	ii+1,	i+—.
th. I:	1,	1+i,	1.
th. II, III:	ii+1,	iii+1+s,	ii+1+s, ii+1.
abd. I-III:	i+1,	ii+1+s,	i+1, 4—5.
abd. IV:	i+1,	i+1+s,	ii+1, 7—8.
abd. V:	ii+1+s+4.		

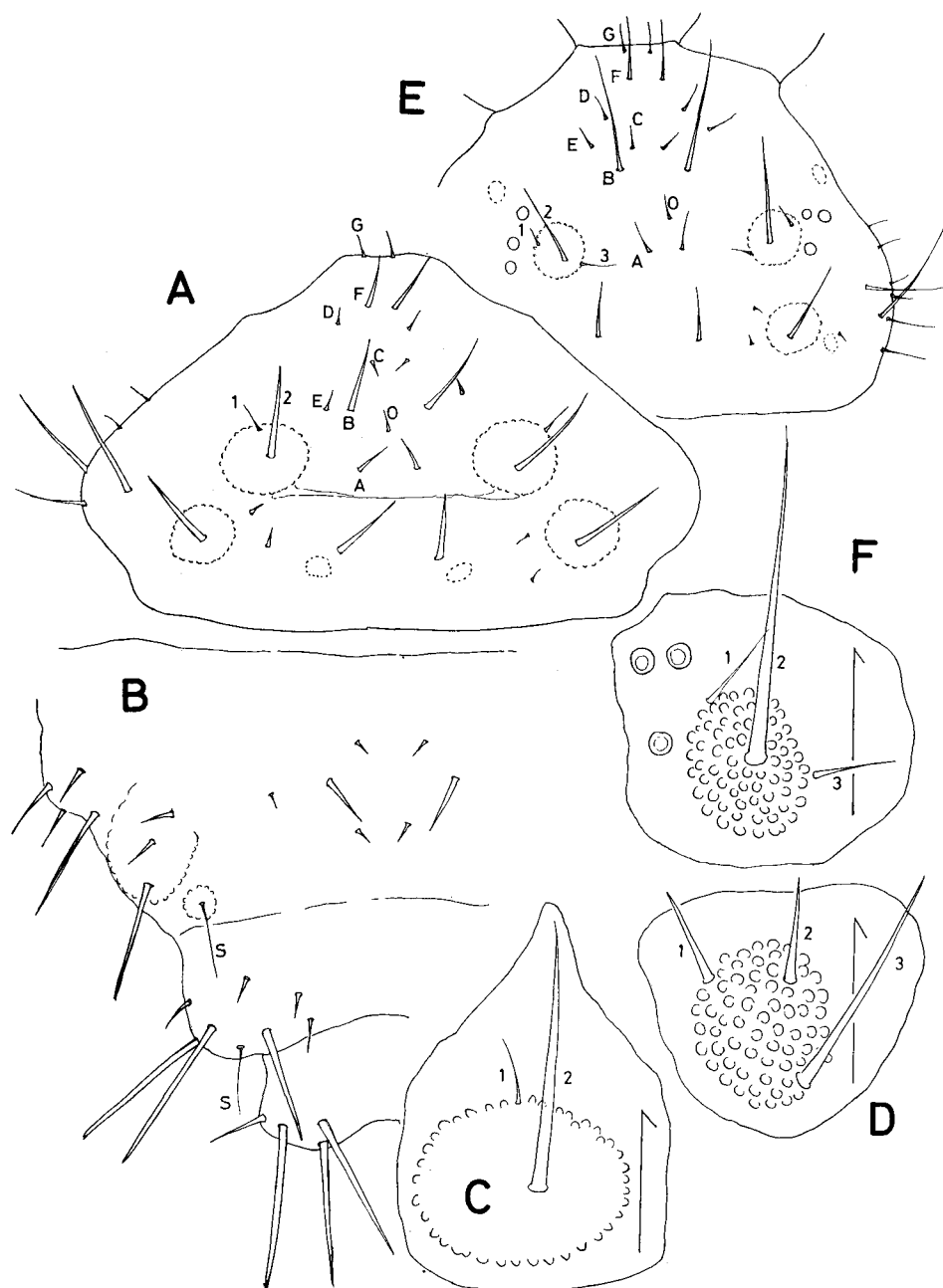


Fig. 3. *Lobella tongana* YOSHI A: head, B: abd. IV-VI, C: ocular tubercle.
Lobella pacifica sp. n. D: ocular tubercle.
Lobella halophila (YOSHI) E: head, F: ocular tubercle.

On abd. V dorsal tubercle is united with the lateral one completely, without forming the furrow between them. Setae are much more slender than in *L. pacifica* sp. n.

The species is different from *L. pacifica* sp. n. and *L. tongana* Yosii by the presence of 3+3 eyes and by the number of setae of the dorsal group, which is 2+2 in this species and 3+3 in others.

The species is known only from the type locality, the Tokara Island of the Ryukyu archipelago.

Isotomidae

10. *Archisotoma utinomii* sp. n.

Kirimezaki, Pref. Wakayama (many ex. 15. IV 1970, R. Yosii); Mogi, Pref. Nagasaki (7 ex. 4. V 1970, R. Yosii).

Body length up to 1.5 mm. In alcohol the colour is pale brown to dark brown and strongly mottled. Segmental margins and ventral side are pale. ant.: head as 75:60, ant. segm. ratio as 15:20:20:22. Ant. IV with a low apical swelling and some

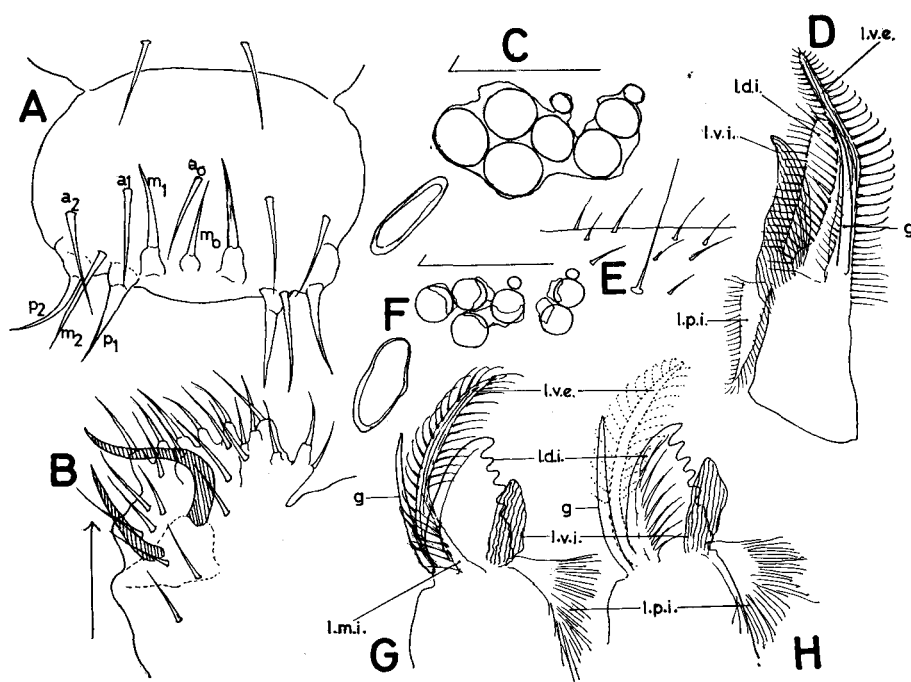


Fig. 4. *Archisotoma utinomii* sp. n. A: labrum, B: labium, C: eyes and postantennal organ, D: maxilla, E: s.s. on abd. V. *Archisotoma tokiokai* sp. n. F: eyes and postantennal organ, G, H: maxilla (H is in a deep forcuss to observe the opposite side of G).

curving sensory setae. Ant. III-organ is composed of two blunt, short rods and without other sensory elements. Ant. II bears a small swelling dorsally near the distal margin. Eyes 8+8, G, H small and without cornea, they are lightly pigmented

to form a common eye-patch. Postantennal organ is narrow, 1.5–2.0 times the diameter of an adjacent eye. Labrum constricted basally, labral setae are as 2/5, 5, 4, where the setae of *m*- and *p*-row are on high basal papilla with the exception of *m*-2, which is placed between the thick *p*-1 and *p*-2. Maxilla strongly lamellate, the claw (*g*) is slender and spike-like, attaining the apex of l.d.i. (nomenclature after POINSOT 1965). l.v.i. is flap-like, with undulating striae as usual. l.d.i. is with a double lamella densely fringed and surpassing the l.v.i. in length. l.v.e. is very long, narrow and densely fringed with long, curving setulae. Mandible is with 4 apical teeth and basal molar area as usual of the genus. Labium is also modified, the median part of the labial papillae is turned to the inside and there are two prominent setae at the place, the inner one of which is strongly developed and sigmoid in form, while the other is simple and spiny in appearance. Legs are short, unguis slender, un-toothed. Unguiculus acutely ending and broadly lamellate on inner side. Tenent hair is absent, but one dorsal seta near the unguis is thick in hind-legs, besides the hind-femur bears a small spur-like process at the distal end. Ventral tube short, without setae on anterior and posterior face and each lateral flap bears 6 setae on it. Rami tenaculi quadridentate, corpus without seta. Furca well extended, man.:d.:mu. as 50:40:7. Manubrium ventrally nude, dorsally with ca. 20 scattered short setae in symmetrical arrangement. Dentes is not converging, with many setae ventrally on distal two thirds and with fewer setae dorsally, the latter are divided in two groups, the proximal and distal group. Mucro is bearing three teeth, all of them are equally lamellate. The apical tooth is elongate, lightly curving, the inner one is at about the middle, the outer tooth is near the basis of mucro. A mucronal seta is to be observed. Integument is practically smooth, but with very fine granulation in large magnification. Body polychaetotic, with many fine, simple setae equally dispersed. Abd. V and VI are confluent and there is a pair of s.s. near the anterior margin of the segment. It is in one pair in strongly coloured large examples of female sex, while it is in two pairs in small (1.0 mm.) examples with pale colouration, whose genital orifice is not yet formed.

Typus: 1 ♀ from Kirimezaki, Pref. Wakayama.

The species is very near *A. besselsi* (PACKARD) sensu POINSOT 1965 in the details of the body and of the maxillar head. But in the cited species *g* and l.d.i. are smaller than l.v.i., while they are subequally large or even surpassing l.v.i. in this new species. The material is taken from the sea shore under the cliff among pebbles in low time. All materials at hand are seemingly females. That the pale form bears 2+2 s.s. on abd. V instead of 1+1 deserves further notice. In *A. besselsi* (PACKARD) it is reported as 2+2 by various authors. With my best wishes the species is dedicated to Prof. F. UENOMI of the laboratory.

11. *Archisotoma tokiokai* sp. n.

(Fig. 4 F-H)

Hatakejima in Seto, Pref. Wakayama (29 ex. 19. VII 1958, R. YOSII); Miyajima, Pref. Hiroshima (7 ex. 9. V 1970, R. YOSII).

Body length up to 1.0 mm. Colour dark green in living, but dirty gray to brownish gray after preserving in alcohol. Pigment is mottled all over, segmental margins are pale. The species differ from the precedent *A. utinomii* sp. n. only in the structure of maxillar apex. In other characteristics it is concordant with it as already known in European species of the genus. The structure of labrum and labium is as in *A. utinomii* sp. n., but maxilla bears quite a different form. In this species the inner lamella of l.d.i. is strongly chitinized and its margin is serrate to form 5-6 round teeth, although its inner side is with long fringed setae and thinly lamellate. g is elongate and whip-like, l.v.e. is narrow and long, bearing a row of long ciliation to all sides of it. l.v.i is undulating, shorter than the chitinized l.d.i., while l.m.i. and l.p.i. are hyaline and insignificant as in other forms. In general eyes are poorly pigmented, not to form a definite eye-field. G, H are small, but distinctly present. Abd. V+VI bears only 1+1 slender s.s. in both sexes.

Typus: 1♀ from, Hatakejima, Seto.

The species is near *A. pauliani* DELAMARE, 1953 of Madagascar in the form of maxilla, but in the cited species l.d.i. is reduced, shorter than g, while it is elongate, well developed and surpassing g by far in the present species. The type material is collected from a small tide pool, where insects are actively hopping around the rocks coated with green algae. In Miyajima the examples were found among the heap of *Sargassum* on the sea shore. From the coast of USA another species of this halophilous genus, *Archisotoma laguna* (FOLSOM, 1937) comb. nov. is already reported. But the species is unknown of the details of the maxillar structure. With my best wishes the species is named to commemorate Prof. T. TOKIOKA of the laboratory.

12. *Axelsonia nitida* (FOLSOM, 1899) sensu YOSII 1966

Hatakejima in Seto, Pref. Wakayama (2 ex. 19. VII 1968, R. YOSII); Shiroyazaki in Tomioka, Pref. Kumamoto (3 ex. 28. IV 1964, T. KIKUCHI).

As I have cited before the present species differs from the European *A. litoralis* (MONIEZ) in the chaetotaxy of the ventral tube. *Isotoma* (s. str.) *pteromucronata* UCHIDA, 1965 from Iriomote, Ryukyu would be, in all probability, a synonym of the present species. The species is already known from Japan, India and New Caledonia.

13. *Isotoma* (*Halisotoma*) *pacifica* sp. n.

(Fig. 5)

Hashikuiwa in Kushimoto, Pref. Wakayama (many ex. 14. IV 1970, R. YOSII);

Tomioka, Shirowazaki, Tororo and Tsujijima in Amakusa, Pref. Kumamoto (many ex. 4-6, V 1970, R. YOSHI); Miyajima, Pref. Hiroshima (1 ex. 8. V 1970, R. YOSHI); Hara in Shimabara, Pref. Nagasaki (7 ex. 7. V 1970, R. YOSHI).

Body length up to 1.4 mm. Colour light gray to dark gray, strongly mottled. Segmental margins are pale. Antennae dark, other extremities pale. ant.: head as 13:6, ant. segm. ratio as 2:3:4:4. Ant. IV with a low subapical swelling and some sensillate setae. Ant. III-organ is two blunt rods without groove. Eyes dark, 8+8 in number, but G, H are much smaller than others. Postantennal organ is broadly ovate, about two times the eye in length and lying directly before eyes.

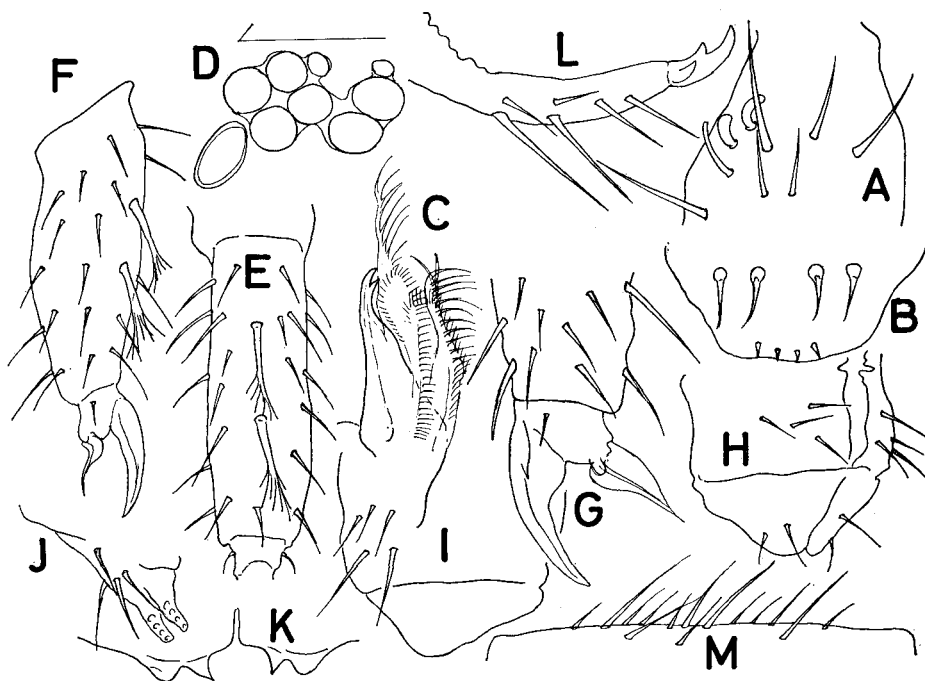


Fig. 5. *Isotoma pacifica* sp. n. A: ant. III-organ, B: labral margin, C: maxilla, D: eyes and postantennal organ, E, F: mid-tibiotarsus, G: hind claw, H, I: ventral tube, J: tenaculum, K: terminal thickening of manubrium, L: mucro, M: setae on abd. III.

Labrum with setae as 4/5, 5, 4, setae of the distal two rows are on a small papilla. Labral margin bears four minute spinulae in a row. Mandible not modified. Maxillar head is strongly reduced as in case of *Archisotoma*. The distal claw is obscurely bidentate and with complicated lamellar structures. They are divided into outer and inner ramus, both of which are fringed and with broad, delicate lamellae, whose margins are minutely ciliated. Labium not much different from others, but the small inner ramus with two setae is divided from the rest of the papillate lobe of labium. Unguis is rather short, narrow and without inner tooth. A pair of dorsolateral tooth

is to be observed in the dorsal view of the unguis. Unguiculus is acute, untoothed, with curved inner and broad outer lamella. Tenent hair is absent, but the hind-leg bears one distal dorsal seta stronger than others. Tibiotarsus of the mid-leg bears two modified setae dorsally, they are strong and finely penicillate distally. Ventral tube anteriorly with 4+4 setae, posteriorly with five setae and each lateral flap is bearing two setae constantly. Rami tenaculi quadridentate, corpus with four equal setae. Furca in ratio as 30:65:3. Manubrium ventrally with many setae, distal ones are stronger, but not forming spines. Terminal thickening is with a cuspidate spine and a round projection outside of it. Dentes converging, ventral setae numerous, dorsal setae few in number. Mucro tridentate subequally, but the apical tooth is considerably projecting, the third tooth is on the outer side of the mucro. All the body setae are smooth, never barbed nor serrate. Abd. VI is distinctly separate from abd. V.

By the presence of two modified setae on mid-tibiotarsus the species is a near relative of *I. boneti* DELAMARE, 1953 of the European sea shore. But these setae are simply bi- or trifurcate in the cited species, while they are multiramous or penicillate in the present species. That the lateral flap of ventral tube bears only two setae is very characteristic. All examples are collected from the heap of kelp along the sea shore.

Entomobryidae

14. *Entomobrya* cf. *marginata* TULLBERG, 1871

Shikanoshima in Hakata, Pref. Fukuoka (3♀, 7. IV 1970, R. YOSHII); Takahama in Amakusa, Pref. Kumamoto (4♀, 6. IV 1970, R. YOSHII).

The pale species with faint marginal band to each tergites. In colouration it is near *E. marginata*, but labral margin has the tubercles alike to that of *E. nivalis*. As the male genital orifice is not yet investigated the full description is retained.

15. *Entomobrya thalassicola* YOSHII, 1965

Tororo in Amakusa, Pref. Kumamoto (15 ex. 5. V 1970, R. YOSHII).

With its truncate form of unguiculus and colourless body the species is very easily to be identified. It is described from Usa, Pref. Kochi and this is the second report. Chaetal arrangement of this species is very unique. That of abd. III is very constant in all examples, but the setae are numerous on abd. II. In Usa examples there may be found 8 setae between the space of two s.s. of the segment. In Amakusa examples, which are larger in body length, the number is augmented to 15 or more.

Tomoceridae

16. *Pogonognathellus* sp.

Tomocerus flavescens flavescens: UCHIDA et TAMURA, 1966

The species is reported from the beach of Akkeshi, Hokkaido. In the converging outline of the mucro it resembles *P. borealis* YOSII, 1967, but whether the basal tooth of mucro has a toothlet or not is unknown.

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